

# User and installer Manual

## Sinewave Inverter, Battery charger

*COMPACT C1312*  
*COMPACT C2324*  
*COMPACT C3548*

Temperature sensor **CT-35**  
Remote control **RC-01**  
Solar charge regulator **Cxxxx-S**  
Remote power sharing **RPS-01**  
AC cable cover **CFC-01**  
IP-23 top cover **CxxxxIP23**



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# 1 General Information

## 1.1 Operating instructions

This manual is a part of the delivery package of every COMPACT inverter-charger. It serves as guidelines for safe and efficient operation of COMPACT. The instructions are only valid for use with the following devices and options:

- COMPACT C1312
- COMPACT C2324
- COMPACT C3548
- Temperature sensor CT-35
- Remote Control RCC 01

Every person who installs a COMPACT and/or works with it must be fully familiar with the contents of this manual and must follow exactly all the warnings and safety instructions. Installation of or any work on the COMPACT must be carried out by a qualified and trained personnel. Installation and application must comply with the respective local installations codes and safety regulations.

## 1.2 Quality and Warranty

During production and assembling, all COMPACT appliances go through many controls and tests. Fabrication, controls and tests are carried out in accordance with firm and established procedures. Every COMPACT has its own serial number, which helps to refer back to its original data in the event of controls or repairs. That is why you should never remove the identification plate showing the serial number. The production assembly and tests on all COMPACT appliances are totally carried out in our company in Sion, Switzerland. The warranty for these appliances is valid for uses and operating possibilities mentioned in this manual .

The warranty period for the COMPACT is 2 Years.

## 1.3 Warranty Disclaimer

We do not accept any responsibility for any damages occurring through use, manipulation, working situation and handling, which are not explicitly mentioned in these operating instructions.

Following cases are not covered by the warranty:

- High voltage at INPUT (i.e. 48V at the Battery INPUT of COMPACT 1312)

Reverse polarity on Battery connections(+/- reversed)

Running liquid or oxidation through condensation in the appliance

Defects caused by force, physical or mechanical means

Changes not explicitly authorized by Studer INNOTEC

Not or only partly tightened screws and nuts after change of fuses or connecting cables

Connecting other sources of energy such as PV-Modules on the INPUT „SOLAR +/-„

Transport damage, i.e. through bad handling and /or packing.

## 1.4 Liability Disclaimer

Respecting this manual, servicing and method of installation, functioning, application and maintenance of the appliance can not be controlled or supervised by Firma Studer INNOTEC. Hence we do not accept any liability and responsibility for damages, loses and costs which result through the use of this appliance or which result through incorrect installation, incorrect operation or wrong application and maintenance or which by some other means maybe connected together to these. Similarly, we do not accept any responsibility for any violation of the patents rights or violation of any third party's rights resulting from the use of this appliance

Studer INNOTEC reserves the right to modify the technical data or these operating instructions without issuing any prior notice.

## 1.5 Precautions

This manual must be readily available for the user at all times. The user must be familiar with the precautions and safety aspects.

During operation of COMPACT, high tensions are generated at the connections and inside of the appliance which could be deadly fatal. Work on the appliance and on the installation should only be carried out by qualified and trained personnel.

The whole installation connected with the COMPACT must comply with the respective valid codes and ordinances.

Persons without the written authorization from Studer INNOTEC are strictly forbidden to carry out any changes or repairs on the appliances. For authorized changes only original parts are to be used.

The COMPACT may only be used when it has been installed in accordance with these instructions and all parts have been correctly assembled and installed.

On the IN- and OUTPUT points of the COMPACT only the already selected energy sources and consumer devices should be connected.

In order to carry out any maintenance or repair work on the COMPACT without danger, all connections must be disconnected beforehand.

**Caution: Even when a COMPACT has been disconnected from the all connections, at the OUTPUT point there could still be deadly fatal tensions present. To remove these tensions you must switch on the COMPACT ON with the ON/OFF switch. After one minute the electronics are discharged and any work can now be safely carried out.**

The COMPACT is only suitable for internal use and under no circumstances should it be subjected to snow, rain, or any other wet conditions

By installations in motorized vehicles the COMPACT must be protected from water-spray and any other wet conditions..

The COMPACT may only be connected to lead –acid or lead-gel batteries.

**Caution: In normal use lead-acid and lead-gel batteries give out explosive gases. Never smoke or allow a spark or flame in the vicinity of batteries. The batteries must always be stored or placed in a well ventilated area, they should be placed in such a way that there is no danger of short circuiting through carelessness. Never charge frozen batteries.**

The COMPACT is not to be used or sold for life support equipment or applications.

## 1.6 Special Precautions

While working on batteries there should always be a second person close to you or within your voice range, in case help is needed.

Plenty of fresh water and soap must be ready at hand so that in case of acid coming in contact with skin, eyes and clothes, the areas in question can be thoroughly washed.

If acid enters the eyes, you must thoroughly wash the eyes with cold running water for at least 15 minutes. It is recommended that you immediately consult a medical doctor.

Baking powder neutralizes battery acid electrolyte. Always keep some at hand.

Special care must be taken when working with metal tools near or on the batteries. With tools such as screwdrivers, spanners etc. short-circuits can result. Sparks produced by the short-circuit can cause an explosion.

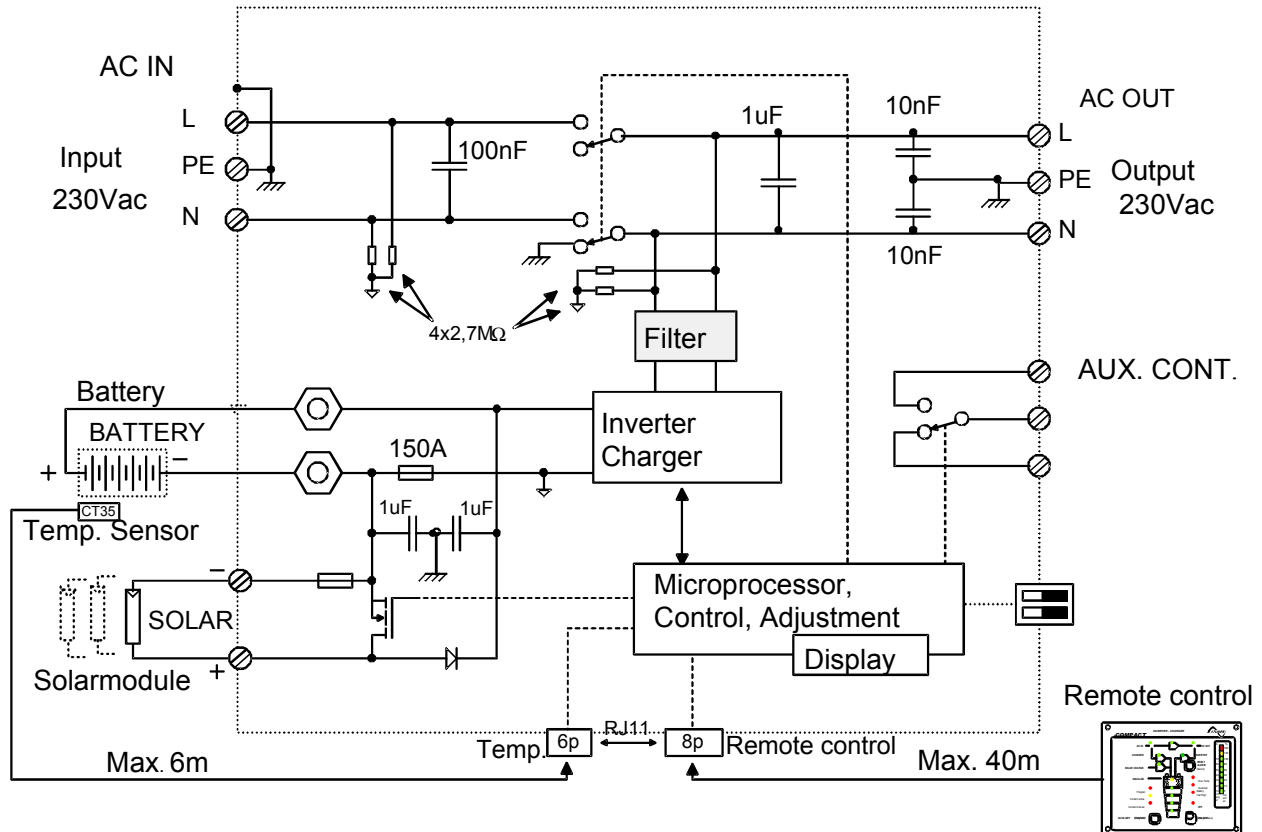
When working on batteries all personal metal items such as rings, necklaces and bracelets must be removed. Batteries are so powerful that short-circuit with these items can melt them and thus cause severe burns. Always follow the battery manufacturers instructions.

Under certain conditions COMPACT or a connected generator can start automatically. While working on an electrical installation you must ensure that these appliances are disconnected beforehand from the installation.

## 2 Introduction

The COMPACT is a sine wave inverter with integrated battery charger and solar charger regulator with many additional functions, it has been developed to be used as stand-alone (independent of a grid-system) AC provider, or as continuous / break-free current supply provider.

### 2.1 Principe schematic



### 2.2 Description of main functions

#### 2.2.1 The Inverter

The sinewave-inverter built in the COMPACT generates a sinusoidal AC voltage with an exceptionally precise voltage and stabilized frequency. In order to start large electric motors, the user has the possibility to employ a short-start-power which is 3-times the nominal power of the COMPACT.

The inverter is protected against overload and short-circuit. A power-stage with the latest MOS-FET power transistors, a toroidal transformer, and a fast regulating system make-up a robust and reliable inverter with highest efficiency. An 1-20 Watt adjustable charge detection system serves to provide the smallest energy consumption and ensures a long life for the battery.

#### 2.2.2 The Transfer system

COMPACT can be connected to an AC source. For example a stand-by emergency generator or the AC network. With the transfer system, on one side you have an alternating voltage at the output for use by the connected consumer devices. On the other side the batteries are charged. The distribution of energy between the consumer devices and battery charger is automatic.

#### 2.2.3 The Battery charger

The built-in battery charger is so arranged that it can charge the batteries quick very completely. A microprocessor controlled, 3 to 4 Step charging process ensures the optimum charging of the batteries. The desired charging current can be set continuously from 0 – 55A (C3548: 0 - 50A). The battery charger is meant for the lead-acid and lead-gel batteries. Thanks to the floating charge system the batteries can remain continuously connected.

### 2.2.4 The solar charge regulator (optional)

With the built-in solar charge regulator, the COMPACT is a complete solar-power-center. In a solar installation this regulator ensures that the batteries are charged correctly. With the COMPACT, batteries can be charged with a generator and with the solar modules at the same time. The charging of batteries with both energy sources is carried out fully automatically.

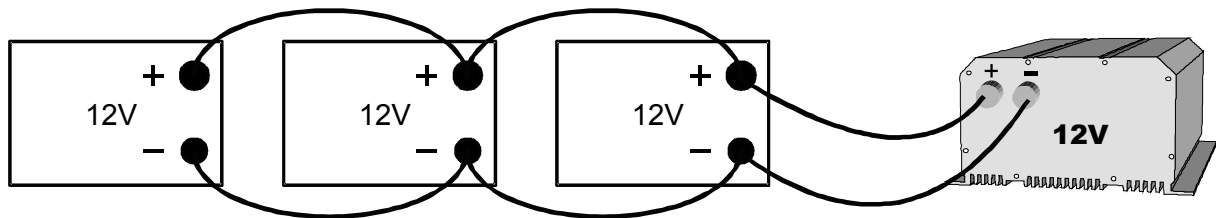
### 2.2.5 Remote control

As an option, a remote control can be connected to COMPACT. All operating elements and displays with the exception of the level adjustment are available on the remote control. The remote control is furnished with a 20m long cable. This cable can go to 40m long. On the remote control output power and charging current are also shown.

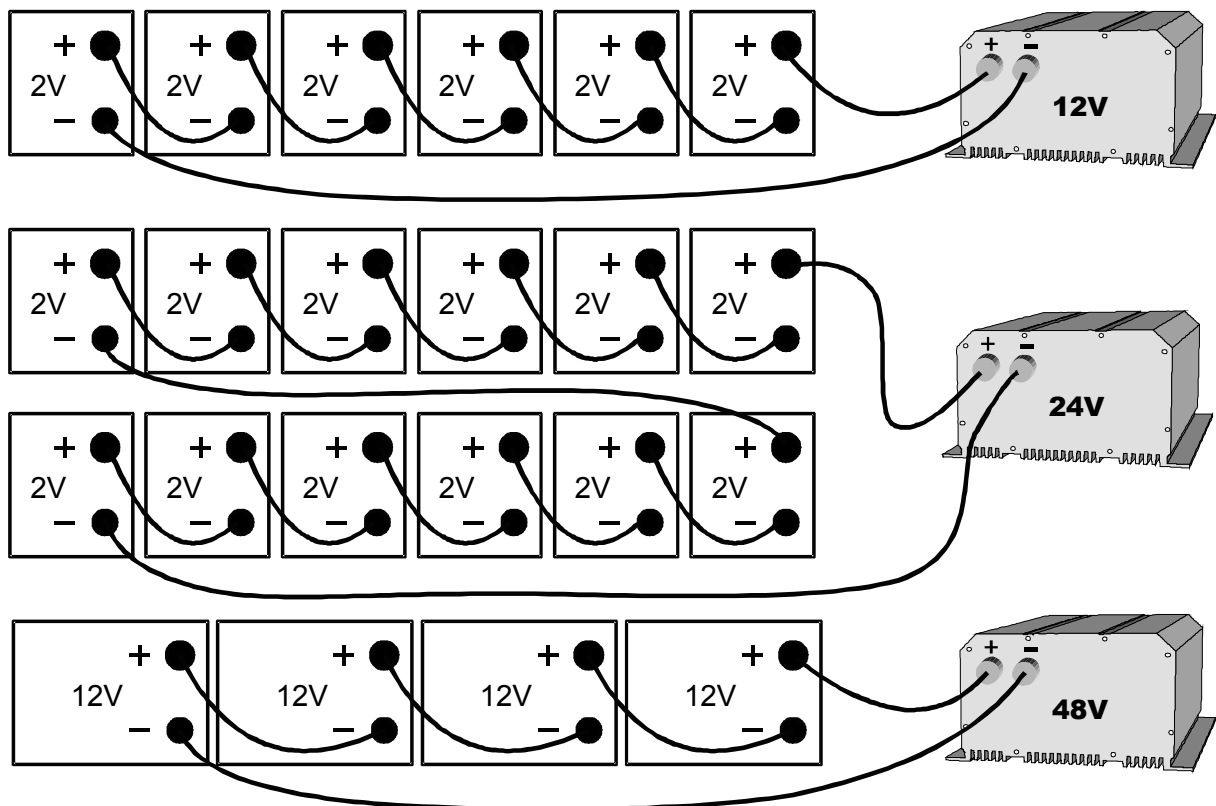
## 2.3 Battery connections

Lead-acid batteries are normally available in blocks of 2V, 6V or 12V. In most cases, to generate the necessary operating voltage and the capacity of the batteries for the COMPACT many batteries have to be connected together in parallel and or in series. Following three examples are shown:

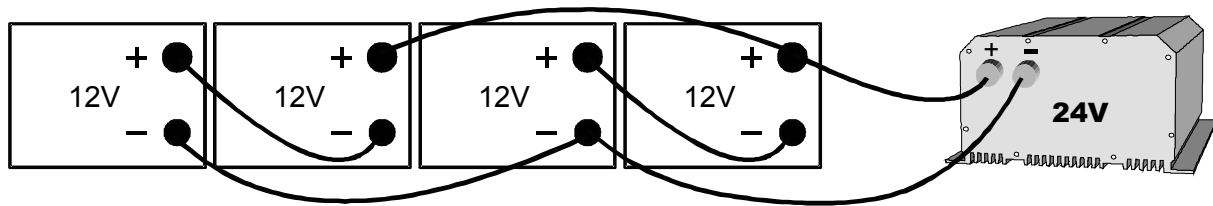
### 2.3.1 Parallel Connection:



### 2.3.2 Series Connection:



### 2.3.3 Parallel- Series Connection:



## 3 Assembly

### 3.1 Place of assembly

The location of the COMPACT must be chosen by the following criteria:

Protection from unauthorized handling.

Dry dust free room, no condensation.

Never install directly over the battery and never in a cabinet together with the batteries.

Keep ventilation holes free. The ventilation of COMPACT is designed in such a way that it can only work efficiently when the appliance is fully laying on its back.

In mobile installation it is important to keep the vibrations down to as low as possible.

### 3.2 Fixing

#### 3.2.1 Compact

Basically the COMPACT can be installed in any desired location. Preferred is that the appliance be wall mounted with battery cables downwards. The COMPACT is fixed on the wall with four screws through the four holes (dia. 5.5mm) which are accessible from the outside. In motor vehicles COMPACT must be fixed on vibrations reducing elements. The COMPACT must not be fixed on a combustible base, as the back of the casing can get hot and reach up to 80 degree Celsius.

#### 3.2.2 Protection cover IP23

This cover IP23 (Order ref. CIP-23) can be easily installed after the fixation of the COMPACT. For that's release a little the too screws down and more the tow up. Then it's possible to pass the IP 23 cover between the COMPACT and the wall. The cover must touch the screws. Lock on the four screws, it's ready.



### 3.3 Connection

#### 3.3.1 General instructions on connecting

The cable connection on the terminals AC INPUT / AC OUTPUT / 15A 230VAC are carried out with a screwdriver Nr.1 and the connection on the SOLAR terminal with a screwdriver Nr.2.

The conductor cross section on the terminals AC INPUT / AC OUTPUT / 15A 230VAC of the connecting cable must be minimum. 2.5mm<sup>2</sup>.

All connecting cables and also the mounted battery cables, must be fixed with strain relief clamps. The COMPACT is delivered with battery cables already connected.

The battery cables must never be extended. If the extension is unavoidable then the conductor cross section must be elevated accordingly.

To protect the battery cable, a fuse corresponding to the conductor cross section must be fixed directly on to the battery.

All cables must be tightly screwed in place. For safety, an yearly control is recommended. In mobile installations control must be carried out more often.

Connecting must be done by qualified personnel. Material such as cable, connectors and distribution boxes, fuses etc. used in the installation must comply with the respective valid low-voltage installation rules and regulations.

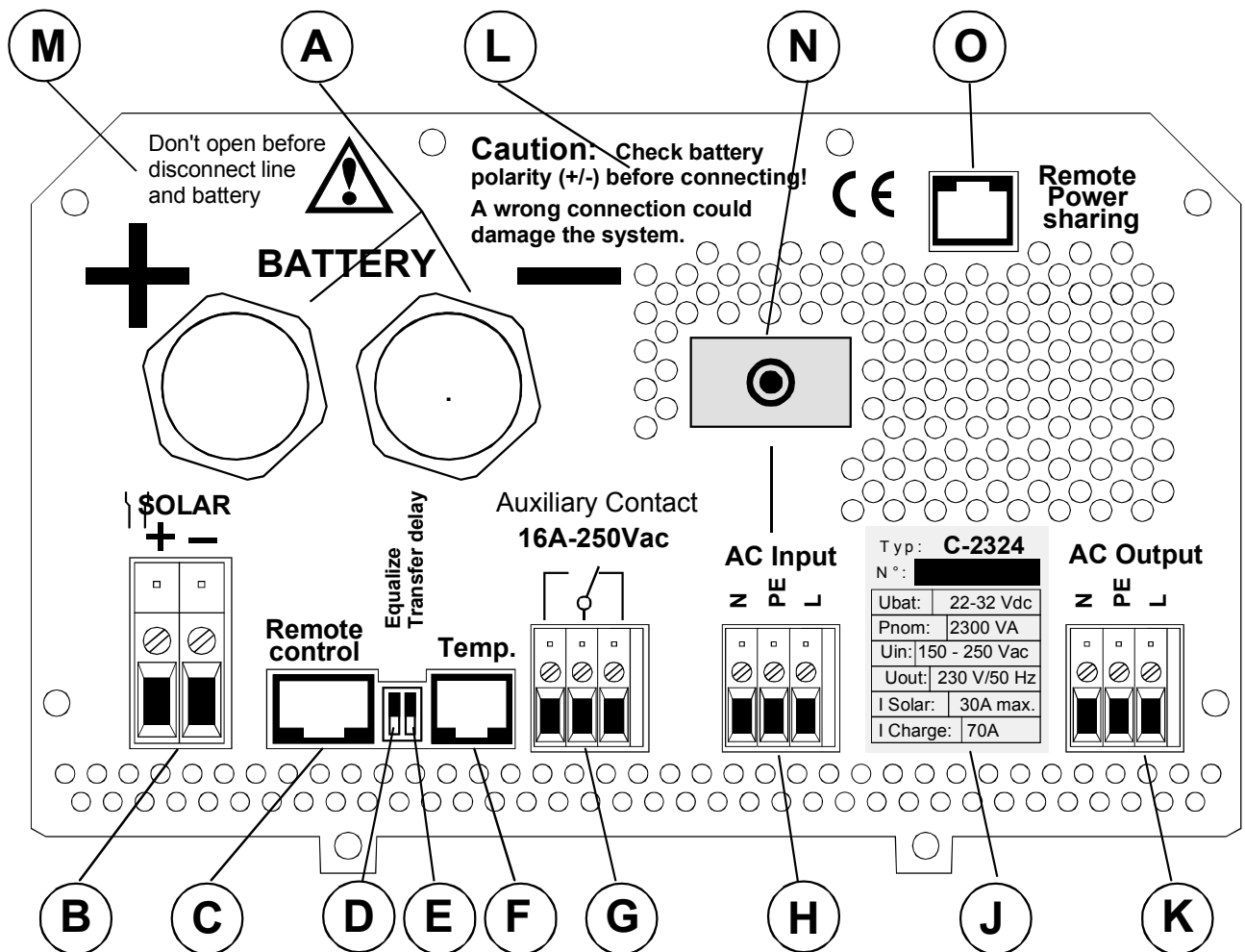


### 3.3.2 Protection cover for the terminals connections

The protection is available in option (Order ref. CFC-01) and avoid to do wrong hazardous connection on the terminals 230Vac. It mounted with strain relief clamps for the cable.



### 3.4 Connecting Plan / Front side



- A Battery +/- Battery cable (already installed)
- B SOLAR +/- Connecting terminal for Solar modules
- C Remote contr. Connecting terminal for Remote Control RCC-01
- D Equalize Slide switch for equalization of the Battery
- E Transfer delay Slide switch for Transfer Delay
- F Temp. Connecting terminal for Temperature sensor CT-35
- G Aux. Contact Connecting terminal for Auxiliary Contact
- H AC Input Connecting terminal for AC-input. Located directly above this terminal is the automatic safety cut-out for this terminal.
- J ID Plate Identification plate with Technical data and Serial number

K	AC Output	Connecting terminal for AC-output
L	Caution...	Caution: Check Polarity(+/-) before connecting the battery! Polarity reversal can damage the COMPACT.
M	Don't ...	Do not open without disconnecting all terminals
N	15A Protection	15A Protection switch for the Transfer system
O	Remote Power Sharing	Input current repartition

### 3.5 Cabling/wiring

Connecting of the COMPACT is a very important step in the installation. You must take care that all connecting work is carried out in a clean and correct manner and under no circumstances that a cable is connected to a wrong terminal.

Connecting of the COMPACT must be carried out in the following order. In case of dismantling this order must be reversed.

#### 3.5.1 Pre-installation settings

Before you start with the cabling of the COMPACT you must set the type of battery. In case that sealed-gel batteries are used then you must set the small slide-switch „Equalize“ which is on the front with the connecting terminals, to OFF position. In case of „normal“ lead-acid – batteries, these can handle a higher equalizing charge, the same slide switch can be set to ON position. In case of doubt leave the setting in OFF position.

#### 3.5.2 Connection to battery

Get the batteries ready for connection: Matching battery terminals, matching fuse on a clamp. Prepare battery cables, if necessary press on cable tabs/shoes. Connect red cable on Plus(+)-Pole and the black cable on the Minus(-) Pole. On connecting the second cable to the battery pole a spark is produced, because for a short time high current flows in the COMPACT to charge the capacitors. For this reason follow strictly the safety measures described in this manual. Check if the red LED OFF(13) is lit. If it is not lit, press shortly on the switch ON/OFF (19), now OFF should be lit.

On connecting the battery the COMPACT needs 1 – 2 Minutes to calculate the actual capacity of the battery. During this time the battery condition is shown as 100% charged. (LED 14 – 17 lit).

If the LED 12 Battery Low/High is lit, the battery charge is too low. If the LED 12 Battery Low/High is blinking, the battery charge is too high.

**Caution: With a wrong battery voltage the COMPACT can be destroyed. ( For example: connecting a C1312 to a 48V-Battery).**

Nevertheless. if the COMPACT had been connected with reverse polarity, it is highly probable that the fuse inside the casing is defect. Before opening the casing cover all terminals must be disconnected including the battery. If the COMPACT does not function after the changing of the fuse and correcting of the polarity, it means that it is defect and must be sent for repair.

#### 3.5.3 Connection the 230Vac-Consumer Device (AC OUTPUT)

The 230V consumer device must be connected to the screw terminal AC OUTPUT. For this, use a 3-core cable with a conductor cross section of 2,5mm<sup>2</sup>. Connections are marked as follows “N“ Neutral, “PE“ Earth, “L“ Live.

**Caution: High tension can be there. By sure that's the compact is turn off (LED 13 alight) before the connection.**

#### 3.5.4 Connection the 230Vac Input (AC INPUT)

The 230V-supply from network or from a generator must be connected to the screw terminals AC INPUT. For this use a 3-core cable with a conductor cross section of 2,5mm<sup>2</sup>. Connections are marked as follows “N“ Neutral, “PE“ Earth, “L“ Live.

**3.5.5 Connect the Solarmodules: SOLAR +/- (Only for solar option)**

Solar modules are connected on these terminals. Under no circumstances should any other energy source i.e. wind generator be connected to these terminals! Only solar modules must be connected with two cables +/- . Depending on the power of the modules, the cable cross section should be 2.5 up to 6mm<sup>2</sup> . Before connecting it is necessary to check with a Voltmeter that the voltage of the Module meets the following values:

C1312 17-25V/30A, C2324 34 – 45V/30A, C3548 68 – 90V/20A.

**3.5.6 Connection to Auxiliary Contact:**

On these three terminals is a potential free change-over contact). The maximal permitted current and voltage for this is 16A/250Vac. The DEL 5 "Contact active" show the position of them: alight mind active and off mind non-active. The schematic view of the connections on the front, show the relay in the non-active mode.

**3.5.7 Connection to Remote control:**

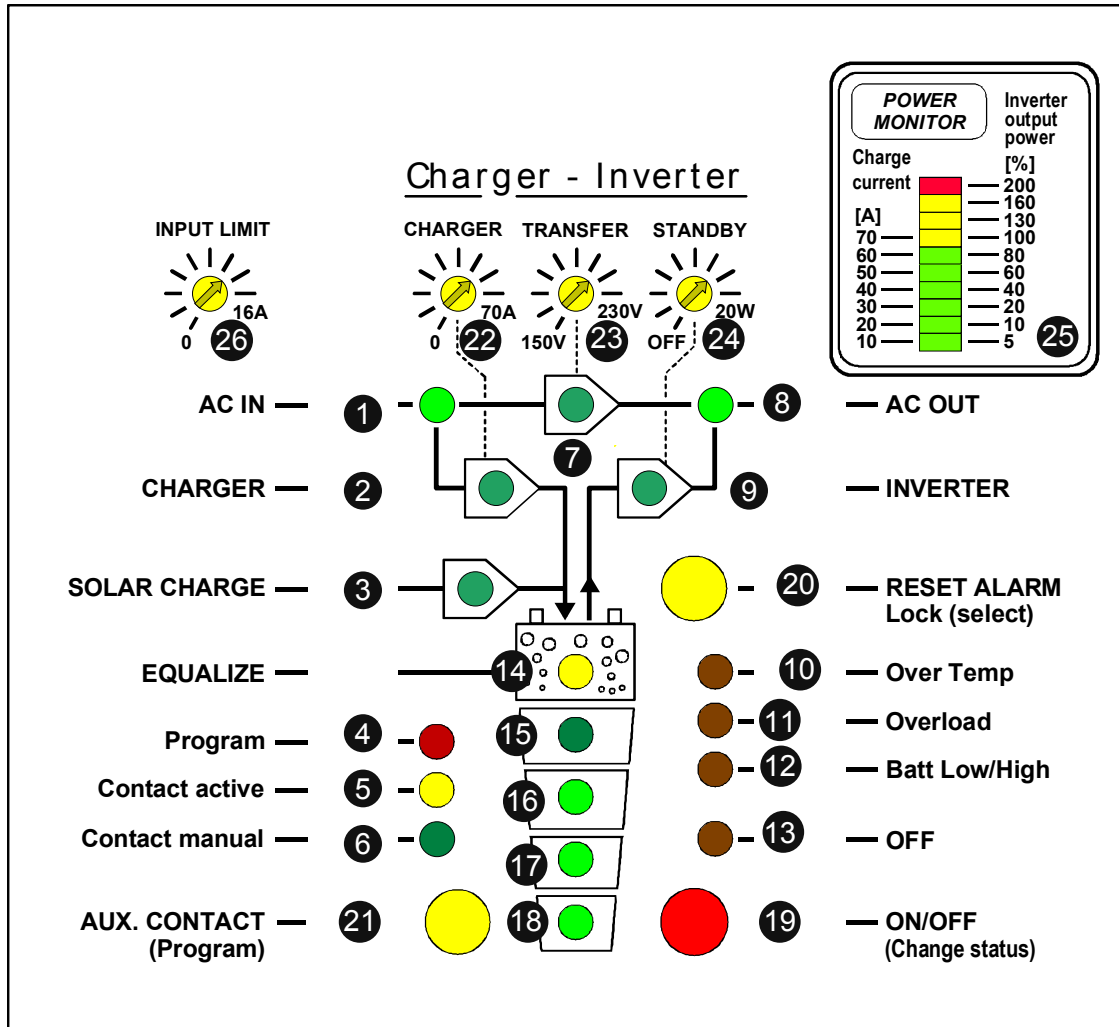
The Remote Control RCC 01 is connected in the terminal marked „Remote control“ with a RJ11/8 connector. The Remote Control can be plugged IN or plugged OUT during any operation situation. Push in the connector, without forcing it, until you hear the „click“, now the connector is locked in place. The same applies to the plug in the Remote Control. The length of the cable for Remote Control should not exceed 40m. We deliver it with 20m cable.

**3.5.8 Connection to Temperature Sensor (Temp.):**

The Temperature sensor CT-35 is connected in the terminal marked „Temp“ with a RJ11/6 connector. The Temperature Sensor can be plugged IN or plugged OUT during any operating situation. Push in the connector without forcing it, until you hear a „click“, now the connector is locked in place. The Temperature Sensor must be glued to the wall of the battery or near it. The Temperature Sensor cable must not be tied together with the battery cables or laid in a rope/bundle.

## 4 Operating

### 4.1 Display and operating control elements



**4.2 Light Emitting Diodes:**

LED	Marking	LED lit	LED blinks
1	AC IN	Voltage corresponding to self-adjusted values is at the AC IN input.	Voltage, outside of the self-adjusted values is at the AC IN input.
2	CHARGER	Battery Charger is working	The input voltage is out value (voltage or frequency)
3	SOLAR CHARGE	Connected Solarmodules are delivering energy	
4	Program	Program mode for Aux. Contact	
5	Contact active	Auxiliary Contact is activated	
6	Contact manual	Aux. Cont. manually activated	
7		Transfersystem is active. Incoming voltage is being sent directly to AC OUT outlet	
8	AC OUT	There is voltage at the AC OUT outlet	The Inverter is in Standby-Mode
9	INVERTER	Inverter is working	Forced -Inverter Mode
10	Over Temp.	For the time being the COMPACT is out of service because of overheating.	
11	Overload	The COMPACT is out of service because of overload or short-circuit	
12	Batt. Low/High	Battery voltage is too low	Battery voltage is too high
13	OFF	COMPACT is turned off. Turning it back on is only possible manually.	COMPACT is for the time being turned off. Turning it back on will follow automatically!
14		Battery Charger and or Solar Charge Regulator are doing an equalization cycle	
15–18		Charge condition of Battery	LED 15 – Absorbtion time is running
25	CURRENT MONITOR	Display the value of the output power in % of P <sub>nom</sub> (in Inverter Mode) and the charge current in Amps. (in Charger Mode) In this mode the 200% LED indicate that power sharing is in use.	

**4.3 Push buttons:**

19	ON/OFF	Turning the COMPACT on and off (Help Button for Programming)
20	RESET	Alarm Signal off (Help Button for Programming)
21	Aux. Contact	Control Aux. contact (Help Button for Programming)

**4.4 Turning Knobs:**

22	CHARGER	Adjustment for max. Charging Current (Not for Solar charge regulator)
23	TRANSFER	Adjustment for Transfer Voltage Threshold(TRANSFER – INVERTER)
24	STANDBY	Adjustment for „Standby“ system
26	INPUT LIMIT	Must be adjusted to the maximal available current of your AC INPUT supply (see on chap. 4.6.3)

## 4.5 The Inverter

An Inverter is built in the COMPACT, which generates a sinusoidal alternating voltage of a very high quality. With this Inverter any alternating voltage consuming device 230Vac up to the nominal power of your COMPACT can be operated. Thanks to the generous dimensioning of the COMPACT, you can operate appliances requiring higher power than the nominal power of the COMPACT for a short time. The COMPACT provide up to 3-times the nominal power to start motors.

The Inverter mode is displayed through LED 9 (Inverter). If the Inverter Mode is disabled (see chap. 5.5) LED 9 will blink. If the LED 9 is lit, the Inverter is in operation and you have 230Vac at output AC OUT. The actual power of the connected consumer device is displayed on the power monitor 25 and on the remote Control.

### 4.5.1 Charge detection system „Standby“

In order to avoid unnecessary discharge of the battery, the inverter switches OFF automatically if no consuming device is connected and switches ON automatically again if a consuming device is connected. The LED 8 blinks if the inverter is in Standby-Mode. The switching-on/starting level can be adjusted with the turning knob 24 „STANDBY. Adjusting the switching-on level is as follows: Switch off all consuming devices; turn the Turning Knob 24 to the right until the LED 8 is blinking, switch on the smallest consuming device (i.e. Mobile phone charger); turn the Turning Knob slowly to the left until LED 8 is lit.

If the Standby- Mode is not wanted, turn the Turning Knob 24 to the left, to the OFF position.

### 4.5.2 Overload

If the Inverter is too long or too heavily overloaded , it switches off. The LED 11 „Overload“ is lit and LED 13 „OFF“ blinks. After ca. 10 seconds the Inverter switches on automatically. If the Inverter is overloaded four times one after another in a short time, then it no longer switches on automatically. The LED 13 remains lit. Press the push button 19 „ON/OFF“ in order to switch on the Inverter.

### 4.5.3 Overheating (Over Temp)

If the Inverter has been overloaded for a long time or it has been working in a to high surrounding temperatures, it will switch off. The LED 10 „Over Temp.“ is lit and the LED 13 „OFF“ blinks. After cooling down, the inverter switches back on automatically. One minute before the inverter switches off for to high temperature it gives out an acoustic alarm signal. If the Auxiliary Contact has been programmed to detect the high temperature then it synchronizes the relay with the alarm signal. In this way, for example, an emergency back up system can be started without any break in the energy supply.

### 4.5.4 Battery Condition

Deep discharging of the lead-acid batteries leads to high losses in capacity and early aging. That is why battery condition is continuously controlled and supervised. With low voltage the inverter switches off. The LED 12 „L/H Batt.“ is lit and the LED 13 „OFF“ blinks. When the battery voltage gets up to 12.1V / 24.2V / 48.4V, the Inverter switches on automatically. One minute before the Inverter switch off due to low voltage it gives out an acoustic alarm signal. If the Auxiliary Contact has been programmed to detect the low voltage then it synchronizes the aux. contact with the alarm signal. In this way, for example, an emergency back up system can be started without any break in the energy supply.

The low voltage is set to 11.8V / 23.6V / 47.2V. These settings are standard for most batteries. These voltage levels are maintained by the built-in Battery-Management-System of COMPACT by matching the load and the battery condition.

This setting is comparable with the levels of 10.8V/ 21.6V / 43.2, which are given for most batteries on nominal load.

All voltage levels can be programmed. See the instructions under the section on Programming. Check your battery supplier as to which voltage values are necessary to be set.

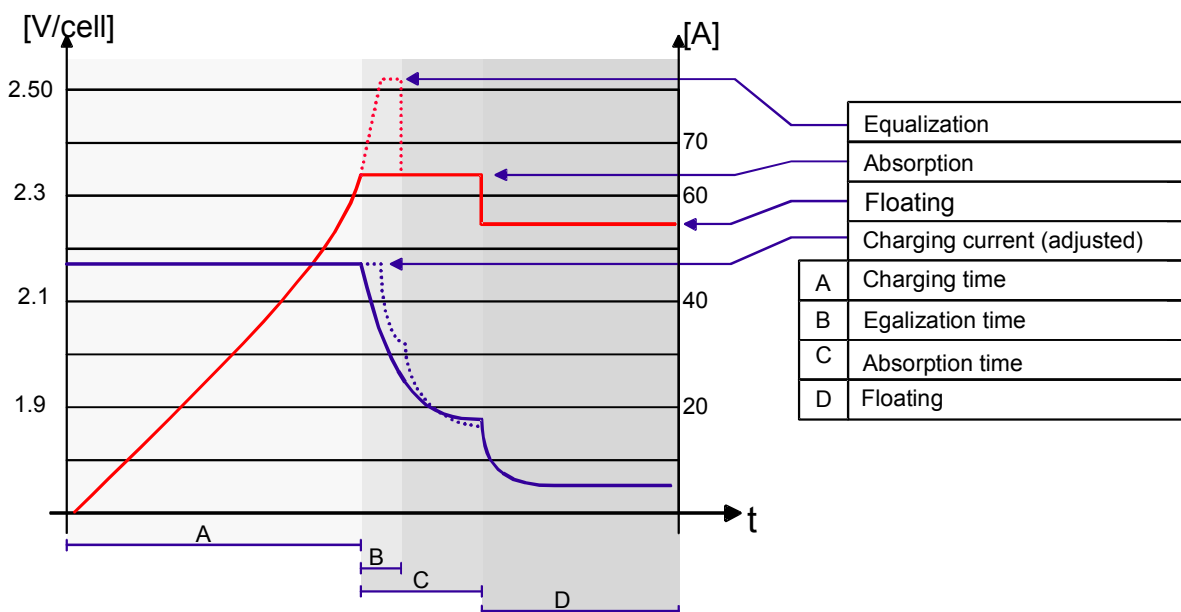
## 4.6 The Battery charger

### 4.6.1 Cycle of charge

The full automatic COMPACT Battery Charger is adjusted at the factory so that most lead-acid and lead-gel batteries can be charged to the maximum. As soon as the minimum alternating voltage for the AC IN set on the Turning Knob 23 is available at the input (LED 1 AC IN is lit), the Battery Charger is switched on automatically (LED 2 CHARGER is lit). The battery is fully automatically charged matching to the charge level, the adjusted voltage levels and the charge current. Thanks to the built-in Float Charge System, the batteries can be left connected for unlimited time with the Battery Charger switched on.

During the charging phase the consuming devices at the outlet AC OUT are continually supplied with power (LED 8 AC OUT is lit).

The charger functions are shown in the following diagram:



### 4.6.2 Equalization charging:

Before you program the COMPACT for Equalization-charge you must confirm with your supplier that the batteries are suitable for this process.

Equalization is recommended for the lead-acid batteries in order to mix well the electrolyte fluid and to clean the lead plates.

#### Equalization mode should never be used when using Gel-Batteries

If the COMPACT is operating with a lead-acid battery, which is suitable for equalization, the slide switch „Equalize“ which is on the cable connection side, must be placed in the ON position. In this setting, at every 25 charge cycles an equalization is carried out for 2 hours (factory setting). During such a charge cycle the LED 14 is lit. Charge cycle with equalization can be started independently of the actual program. For this the slide switch must be slid from “OFF” to the “ON” position. The LED 14 will light up. If the periodic equalization is not required, slide switch must be slid back to the „OFF“ position after the completion of the manual cycle.

**CAUTION: During the equalization process, the batteries produce lot more gas.  
DANGER OF AN EXPLOSION !!**

### 4.6.3 Input current repartition (Power sharing)

For manage the power available on the AC INPUT (depend the supply use) the COMPACT is equipped with a system usually called “Power sharing” or INPUT power distribution. With this function it’s possible to limit the AC INPUT current assigned to the charger. More current it use on

the OUTPUT less it's give to the charger. Priority for the OUTPUT. When the power sharing is used the LED 200% (red) is lit to point out that's the charge is limited.

**Caution: If the power use on the OUTPUT is higher than the value of the INPUT LIMIT (26) the COMPACT limit the current, then the generator means to stop or the circuit breaker before means to break.**

In option, a remote control (RPS-01, 20m cable) allows the Power Sharing far from the COMPACT.

4.6.3.1 Set the INPUT LIMIT (26)

The current available for the COMPACT depend of the supply used i.e. motor generator, network limit in a camping or shore connections... The value of the turning knobs INPUT LIMIT (26) must by adjust lower or equal of the current available from the source.

Generator power	Current (230V)
500W	2A
900W	4A
1500W	6,5A
2000W	8,5A
3000W	13A

For example if you have a generator of 2kW you must adjust the turning knobs 26 to approximately 8.5A. For calculate this, we divide the nominal power (2000W) by the voltage (230V). If you have a circuit breaker (i.e. 6A) before the COMPACT, then you set this value on the turning knobs (26) (i.e. 6A).

4.6.4 Charging current:

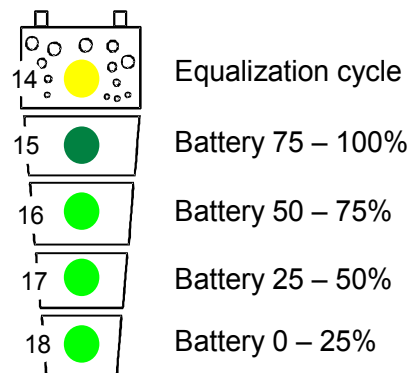
The maximum charging current for the battery can be adjusted with the Turning Knob 22 (CHARGER). The charging current of the battery should be set to approximately 10 – 20% of the battery capacity (at C10). This means that the charging current for a battery with 300Ah should be set between 30 – 60A.

The charging current is displayed on CURRENT MONITOR (25) of the front panel or on the Remote Control .

4.6.5 Battery Condition:

Built-in microprocessor with a specially developed algorithm calculates the actual state of charge of the battery and displays it on LED 15 – 18. The LED 14 is lit when the system is carrying out a charge cycle with equalization.

For safety reasons, you must get the recommended charge voltage and charge currents from your battery supplier. The voltage levels and charge characteristics can be changed through Programming. The instruction for programming of battery charger is in the section „Programming“(Chap. 5.1.2). The correct charging is indispensable for a safe function and long-life of the battery.



4.7 The Transfer system

When an ac voltage is at the input AC IN of the COMPACT, the LED 1 AC IN is lit. When this voltage matches the lowest adjusted value set by the Turning Knob 23 TRANSFER, and the frequency is between 44Hz and 65Hz, this voltage is switched directly to the battery charger and to the output AC OUT. The LED 7 TRANSFER is lit. The inverter is switched off and the battery charger switched on. This process is automatic, unless the charger mode or the transfer mode is disabled (see Chap.5.5)

The maximum current of the Transfer switch is 15A. That means through this system, consuming devices up to a maximum of al 3500 Watt can be operated. When the Battery Charger is working, part of this power is used for the charging according with the power sharing system.

The Transfer system is protected against overload with an automatic safety fuse on the AC Input side of the COMPACT. If the system has been overloaded the button/pin of the fuse will pop-out. To put the automatic safety system back in to operating you must push this pin back.



Note: In the Inverter operation, The COMPACT generates a true sinusoidal and quartz stabilized output voltage. When, however the COMPACT is supplied from a grid or a generator and the transfer contact is active, then you have at the output AC OUT the same voltage as that at the input. This voltage can not be modified by the COMPACT!

#### 4.7.1 Set the transfer voltage threshold

The voltage threshold of the transfer can be adjusted between 150 to 230V with the turning knobs (23). From factory this value is 200V. Majority's of appliances can work on this voltage. When the input voltages reach the settled value on turning knob, the inverter switches off and the AC INPUT goes directly on the AC OUTPUT. When the voltage INPUT is less than the value set, the transfer stops and the OUTPUT switches back on the inverter.

**Don't use the turning knobs "TRANSFERT" (23) to adjust the AC OUTPUT voltage!  
This is only its only a voltage threshold level to enable or disable the transfer.**

#### 4.7.2 FAST (UPS)- MODE for the Transfer Switch

The quick and break free Transfer mode is programmed with a slide switch „Transfer Delay“ OFF, which is on the front side (cable connections side).

The aim of the COMPACT is to supply the consuming device with a break-free alternating voltage. When the incoming voltage AC IN no longer matches values which have been set with the Turning Knob 23, the Inverter switches on at once. The transfer is carried out in 0.02 seconds. This quick transfer ensures a break-free function for most consuming devices. If you have an alternating voltage back at the input AC IN, transfer system starts up again without any break, and the inverter is stopped.

#### 4.7.3 Delayed mode of the Transfer System

The delayed mode of the transfer system „Transfer Delay ON“ is programmed with the slide switch on front with the cable connections. The COMPACT provides a break-free alternating voltage for the consuming device. A quick transfer switch is not always sensible nor is it always desired. For example, when the consuming devices are operated by a small back-up generator. An overload of a short duration on such a generator, i.e. start of a vacuum cleaner etc., has the effect of decreasing the voltage for a short time. As in such cases the transfer to the Inverter is not desirable, the transfer system can be programmed with a delay. When the slide switch (Transfer delay) is in the „On“ position, the transfer to the inverter takes place with a delay of 5 seconds. If the voltage falls below 100Vac, the transfer takes place without delay! The transfer switching to the Inverter takes place without any break.

### 4.8 The Solar charge regulator (option)

The COMPACT also has a Solar Charge Regulator built in. For charging the batteries, Solar modules can be connected to the screw terminal SOLAR +/- . The in-built regulator is a „Shunt regulator“ for the maximum input current of 30A for C1312 and C2324 and 20A for C3548. The operating voltage of Solar panels to be connected must match the actual operating voltage of the COMPACT and never exceeds the max. rated value.

**Under no circumstances should any other systems such as wind-generator be connected at the input of the Solar Charge Regulator.**

The Solar Charge Regulator works automatically and is always in operation. As soon as the energy is delivered from the Solar Charge Regulator, LED 3 "SOLAR CHARGE" is lit and the batteries are being charged. The Solar Charge Regulator works even when the Battery Charger is functioning. The way of working is principally the same as that of the Battery Charger. The function is described in the section on Battery Charger. The programming and the adjustments are carried out in accordance with the same conditions. Check with your battery supplier which adjustments must be carried out for your battery.

### 4.9 The Multifunctional Contact

In the COMPACT there is a built-in programmable power relay. The potential-free change-over contact (NO – NC) of this power relay is connected to the screw terminal AUX CONTACT.

**Maximum Contact load: -230Vac /16Amp-30Vdc/1A!**

With the Push Button 21 „AUXILARY CONTACT“ the contact can be manually switched on or off independent of programming and the operating situation. The LED 5 “Contact active” show the state of the contact. The drawing up the screw terminal “AUX CONTACT” is the inactive position mode, LED 5 “Contact active” off.

The switching on and off of this contact can be freely programmed for every operating situation of the COMPACT witch situation is indicated with a LED. There is no limitation to its application and it is left to your wishes and desires as to where and how you would like to use it. The example and the setting of this contact are explain chapter 5.4.2.

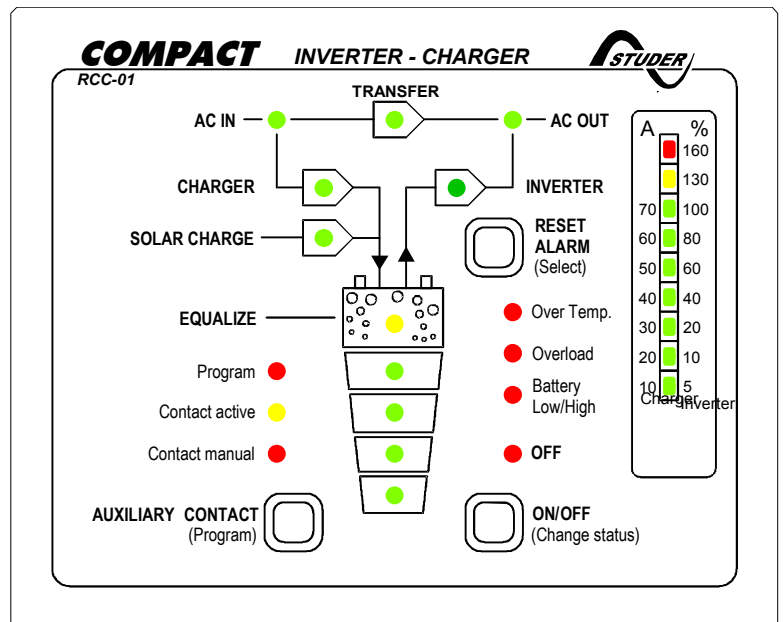
In factory we program this for a dysfunction alarm. The contact is active when one of these situations are detected:

- Over temperature (LED 10 lit)
- Overload (LED 11 lit)
- Over or less voltage of batteries (LED 12 lit or blink)
- COMPACT is turned off manually or with a fault (LED 13 lit)

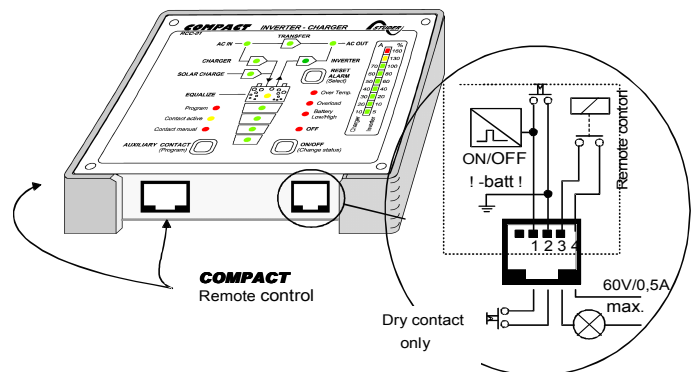
**4.10 The Remote Control**

As an option a Remote Control can be connected to the COMPACT. All operating controls and displays except from level adjustment are available on the Remote Control. The Remote Control is supplied with a 20m long cable. It can lengthened to 40m. The Remote Control is suitable for surface mounting on the wall or on to a switch board. It is fixed with 4 screws. The COMPACT can also be programmed with the Remote Control. The Programming is described in the section „Programming“.

The output power and the charging currents are displayed on the Remote Control.



In the Remote Control there is an additional Alarm Contact and a Control Input built in. These two functions are available through Tip-jack RJ11/4 for use. This Auxiliary Contact is Front / Work Contact (max. 0.5A!), which is independent of the Auxiliary Contact of the COMPACT. This contact is active in case of an alarm of the COMPACT.



The Control Input is connected in parallel to the ON/OFF- push button. The COMPACT can be switched on or off through this input with an impulse button or an impulse contact.

Order Number for Remote Control: RCC-01

Dimensions: H x B x T / 111.5 x 136.5 x 25mm

**Caution: No external voltage should be connected to this Input Control.**

## 4.11 The Temperature sensor

Operating voltage of lead-acid batteries change depending on the temperature. To correct the operating voltages according to the actual temperatures, a temperature sensor can be connected to the COMPACT.

The compensation through the sensor is  $-3\text{mV}/^{\circ}\text{C}/\text{Cell}$ .

Order Number: CT-35

Dimensions: H x B x T / 58 x 51.5 x 22mm

## 5 Programming:

### 5.1 Standard setting

The COMPACT is delivered with the default setting following:

#### 5.1.1 Working mode

The working of the charger, the inverter and the transfer are describe in chapter 5.3/5.4/5.5.

#### 5.1.2 Battery voltage

Low voltage	11.6V / 23.2V / 46.4V
Float Charge	13.5V / 27.0V / 54.0V
End of Charge Voltage	14.4V / 28.8V / 57.6V
Equalization	15.3V / 30.6V / 61.2V
Absorption Time:	2 Hours

#### 5.1.3 Auxiliary contact

Active in case of defect or manual turn off with the LED 10/11/12/13

### 5.2 Reset value

When the COMPACT is to be connected to a battery or after an interruption (RESET), it is always programmed with these standard settings..

In order to get to these settings during operation you must press the three Push Buttons 20/21/22 simultaneously for a minimum of 2 seconds.

### 5.3 Battery voltages and absorption time:

The voltage levels (low voltage, float charge, end of charge and equalization ) and the duration of the absorption charge can be changed.

The display of these voltages and the times in the program mode are in accordance with the diagram shown below:

#### 5.3.1 Table of voltage and timing threshold

LED	Low voltage LED 13			Float Charge LED 12			Absorption LED 11			Equalization LED 10			Absorpt. Time LED 10->13
	12V	24V	48V	12V	24V	48V	12V	24V	48V	12V	24V	48V	12/24/48V
14	12.0	24.0	48.0	13.7	27.4	54.8	16.2	32.4	64.8	16.2	32.4	64.8	4 h
15	11.8	23.6	47.2	13.6	27.2	54.4	15.6	31.2	62.4	15.9	31.8	63.6	3 h
16	<b>11.6</b>	<b>23.2</b>	<b>46.4</b>	<b>13.5</b>	<b>27.0</b>	<b>54.0</b>	15	30	60	<b>15.6</b>	<b>31.2</b>	<b>62.4</b>	<b>2 h</b>
17	11.4	22.8	45.6	13.4	26.8	53.6	<b>14.4</b>	<b>28.8</b>	<b>57.6</b>	15.3	30.6	61.2	1 h
18	11.2	22.4	44.8	13.3	26.6	53.2	14.2	28.4	56.8	15	30	60	0 – 1Min.

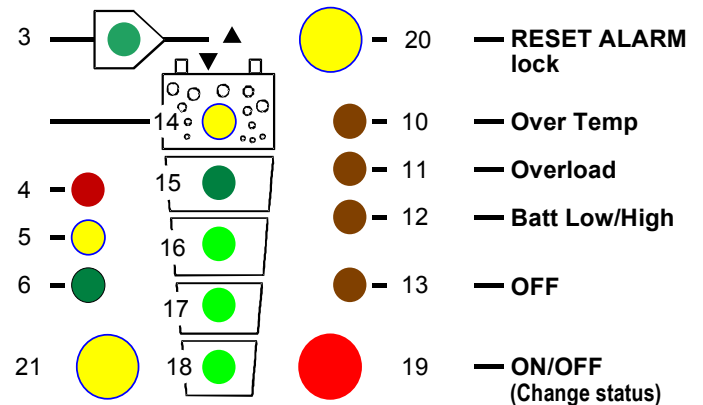
The heavy printed values show the standard settings.

### 5.3.2 Set the voltage and timing threshold

The programming is done in accordance with the following steps:

Push and hold down, the Push Button 21 (Program) and the Push Button 19 (Change status) for minimum 2 seconds simultaneously.

With the Push Button 20 (select) select with of the battery level and the absorption time to be changed.



#### These four red LED show the function set:

Low voltage	LED 13
Float charge	LED 12
Absorption (End of charge)	LED 11
Equalization	LED 10
Absorptions Time	LED 10/11/12/13

With the Push Button 19 (Change status) set the desired parameter (voltage or the time) to modify (LED 14/15/16/17/18). Push Button 19 (Change status) to set the desired value according to the table 5.3.1.

If desired, repeat the operation with any other parameter (voltage or time) to be changed.

If during 10 seconds no buttons are pressed, the selected values are automatically stored and the COMPACT switches back in to the normal operating status.

**The voltage levels and times changed through programming are only first active with the next charge cycle!**

**The voltage level which are not suitable can greatly reduce the battery life or could even destroy it ! Therefore check beforehand with your battery supplier.**

## 5.4 Program the auxiliary contact

### 5.4.1 Principle

The Auxiliary Contact can be basically programmed for any operating situation of the COMPACT which is indicated with a LED. The programming is possible for one or more operating situations. If the contact is programmed for many situations, it is activated as soon as the COMPACT finds itself in any **one** of the programmed situations. That means that workings of the contact meets that of the logic OR-Function.

### 5.4.2 The programming of the Auxiliary Contact is carried out in the following Steps:

The Push Button 21 (Program) press down for min. 2 seconds. The LED 4 „Program“ is lit as an indication, that the COMPACT is in program mode.

A lit LED shows the programmed condition for the auxiliary contact. (LED 10/11/12/13 factory setting)

With the Push Button 20 (select), select the desired condition in which the contact should be activated.

With the Push Button 19 (Change status) confirm or change the status for this condition.

If desired ,with the Push Button 20 (select) select another condition in which the contact should be activated.

With the Push Button 19 (Change status) confirm or change the status for this condition.

If during 10 seconds no buttons are pushed, then the settled values are automatically stored and the COMPACT switches back to normal operating condition.

### 5.4.3 Example

#### 5.4.3.1 Auxiliary Contact as generator starter

When in the programming of the Auxiliary Contact, the Battery Capacity (LED 15-18) is used as a condition, then you must take note of the following requirements.

If you have to start an emergency back-up supply with a battery having a certain residual capacity, then two battery levels must be programmed. The first (i.e. Battery 25% LED 17) for the starting or activating the Auxiliary Contact and the second (i.e. Battery 100% LED15) for stopping or deactivating the Auxiliary Contact. By programming like this the Auxiliary Contact works with the lowest set condition and stops when it has reached the highest programmed condition through charging.

#### 5.4.3.2 Auxiliary Contact as Twilight Switch (With solar charger option)

The Auxiliary Contact of the COMPACT can also be used as a twilight switch , i.e. for operating automatically the exterior lighting. With it the connected solar modules measure the light intensity. If the COMPACT is operating without solar modules and a twilight-switching function is desired, you can connect small solar cells with the nominal voltage of the COMPACT on to the SOLAR terminals for the purpose of measuring the light intensity. To function as a twilight-switch the Auxiliary Contact must be programmed so that the condition SOLAR CHARGE (LED 3) is active. Programming must be carried out in steps and in accordance with the description for the programming of the Auxiliary Contact.

### 5.4.4 Manual operating of Auxiliary Contact:

**5.5 The Auxiliary Contact can be operated at any time with the Push Button 21 (AUX. CONTACT). The LED 6 „Contact manual“ lights up as information that the Contact is manually operated, and LED 5 „Contact active“ lights up when the Contact is active. By pushing the Push Button 21 a second time, the Contact is deactivated. By pushing it the third time, automatic functions are restored.**

### 5.5 Disabling some of the compact functions

Each different function charger, inverter and transfer can be disabled. This is useful for specific applications wthch required to disable some of these tree functions.

If you press the button (20) more than 2 seconds you can have the access to the different possibilities shown in the following diagram.

In programming mode the display show only the different types of program with the three DEL 2,7 and 9 to each functions. To change the type of programming press shortly the button 20 until your reach to the right function use according table below. After 10 seconds the COMPACT exit the programming mode and load the new change.

In user mode, the disabled functions are displayed by blinking LED. So you can see in witch mode is disabled.

5.5.1 Diagram of the different mode

		<p>○ Show an off LED          ● Show a blinking LED          ● Show a lighted LED</p>
	<p>AC IN — ① — ○ —</p> <p>CHARGER — ② — ● —</p> <p>⑦ —</p> <p>— ⑧ — AC OUT</p> <p>— ⑨ — INVERTER</p>	<p>All the functions are enabled. This is the factory setting.</p>
	<p>AC IN — ① — ○ —</p> <p>CHARGER — ② — ● —</p> <p>⑦ —</p> <p>— ⑧ — AC OUT</p> <p>— ⑨ — INVERTER</p>	<p>The inverter is disabled. Only the transfer switch and the charger will work normally.</p>
	<p>AC IN — ① — ○ —</p> <p>CHARGER — ② — ● —</p> <p>⑦ —</p> <p>— ⑧ — AC OUT</p> <p>— ⑨ — INVERTER</p>	<p>Charger and transfer switch are disabled. the inverter will work continuously even if there is a correct AC voltage at the input</p>
	<p>AC IN — ① — ○ —</p> <p>CHARGER — ② — ○ —</p> <p>⑦ — ● —</p> <p>— ⑧ — AC OUT</p> <p>— ⑨ — INVERTER</p>	<p>Inverter and charger are both disabled. Only the transfer switch function is enabled in input voltage and frequency is OK.</p>

6 Maintenance

Apart from the periodic controls mentioned for the connections, the COMPACT does not need any maintenance. Keep the appliance clean and from time to time wipe it clean with a damp cloth.

7 EC Compliance

We hereby state that the products described in this user manual meets the following standards:

EN50081 I/II, EN55014 – EN61000-2-3, IEC801 II/III/IV, LVD 73/23/EEC, EMC Dir. 89/336

CH-1950 Sion, 31<sup>st</sup> of March 2000

STUDER INNOTEC (R. Studer)

## 8 Technical Data

Type	C1312	C2324	C3548
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### Inverter

Nominal battery voltage	12V	24V	48V
Input voltage range	9.5 – 16V	19 – 32V	38 – 64V
Nominal power (W)	1300VA	2300VA	3500VA
Maximum power 30 min	1600VA	2500VA	4000VA
Maximum power 3min.	2000VA	3000VA	4800VA
Maximum power 5 sec	3500VA	6000VA	9000VA
Maximum load	Up to short circuit		
Asymmetrical load max.	Up to Pnom		
Standby adjustable	1 – 25W		
Cos φ	0.1 – 1		
Maximum efficiency	94%	95%	95%
Power OFF, Standby, ON	0.5W-0.6W	0.8W-0.9W	1.2W-1.4W
Power normal working no load	6W	9W	12W
Output voltage	230Vac ± 10%		
Output frequency quartz controlled	50 Hz± 0.05 %		
Maximum distortion	< 2%		
Dynamic behaviour 0 → 100 %	0.5ms		
Overload and short circuit protection	Automatic disconnection with 5 time restart attempt		
Overheating temperature protection	Acoustic warning before shut-off. Automatic restart		

### Battery Charger

Charging current adjustable	0-55A	0-55A	0-50A
Setting of AC INPUT current POWER SHARING	0 to 15A		
Maximum input voltage	265 Vac , 350 V peak		
Minimum input voltage	Adjustable 150 – 230Vac		
Frequency range	44 – 65Hz		
Power factor correction (PFC) EN 61000-3-2	EN 61000-3-2		

### Solar Charge Regulator-Floating

Maximum no load voltage	25V	45V	90V
Maximum charging current	30A	30A	20A
Function principle	Shunt regulator I / U / Uo / equalize		

### Battery Monitoring (25°C) in accordance with TLBM® (True Level Battery Management)

*Absorption charge time	0 – 4h		
*End of charge cycle voltage	14.4V	28.8V	57.6V
*Floating voltage	13.6V	27.2V	54.4V
*Equalization voltage every 25 cycles	15.3V	31.6V	63.2V
*Low battery disconnection voltage	10.8V	21.6V	43.2V
Temperature compensation (Option)	3mV / °C / cell		

### Various data

Potential free Multifunction contact	16A - 250Vac / 3A – 60 dc		
Weight	16.0kg	17.1kg	29.4kg
Dimension H * W * L (mm)	124 / 215 / 480	124 / 215 / 480	124 / 215 / 670
Protection index IP	IP22		
EEC – Compliance	EN50081 I/II, EN 55014 – EN 55022, EN 61000-3-2 IEC 801 I/II/III/IV, CEI 555, IEC 1000-3-2, LVD 73/23/EEC		
Operating temperature	-20 to 55°C		
Ventilation	from 45°C		
Commutation time (UPS-Mode)	20 ms		
Noise level without/with ventilation (dB)	< 10 / < 35 / 50dB		

### Options

Remote control (111.5 x 136.5 x 25mm / 20m Cable)	RCC-01
Temperature sensor (58 x 51.5x 22mm / 3m Cable)	CT-35
Protection cover for terminals	CFC - 01
IP 23 Protection cover for COMPACT	CIP - 23

We reserve the right to make any changes without issuing any prior notice

\*These value can be modified according to the table chapter 5.3.1